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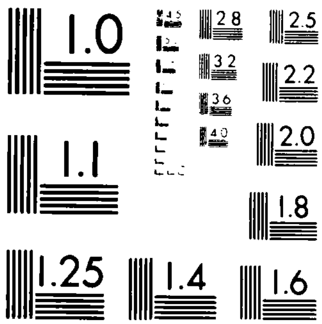
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This model sums the present value of 10 years of net maintenance labor costs, net packing and transportation costs, net additional facility equipment and training costs, and net increased pipeline costs to maintain the same level of readiness for each alternate site. The net cost is the actual estimated cost minus the federal, state and local income taxes, and the reduction in unemployment and welfare costs resulting from the direct and indirect jobs resulting from this expenditure. The Construction Engineering Research Lab economic models were used with the Department of Commerce (see attached sheet)

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U.S. input-output data to provide employment and income multipliers as well as income and employment factors per $1,000,000 of expenditures for several major business sectors.

The principal findings are that:

(1) The net costs to the U.S. Government of performing depot maintenance (and therefore many other military functions) at CONUS sites versus OCONUS sites is significantly less than many previous studies have shown,

(2) The primary factor in determining if it is cost effective to overhaul an item in CONUS vs OCONUS is manhours per item required divided by measurement tons (shipping cubic feet/40) per item, and,

(3) Other major factors are the DM/$1 exchange rate, the total U.S. tax rate, the additional facilities and equipment costs, and annual replacement pipeline costs.

"Mission First"

DESCOM

"People Always"

CONUS VS OCONUS

DEPOT MAINTENANCE

COST COMPARISON MODEL

US Army Depot System Command
Systems Analysis and Evaluation
Office
Carl L. Barton
6 December 1984

TABLE OF CONTENTS

I. INTRODUCTION

A. This report describes a model to compare the cost of establishing and maintaining an OCONUS capability to perform depot maintenance on specific items versus returning these items from an OCONUS site to CONUS sites for depot level maintenance. In the early and middle seventies, the US Army eliminated most of the OCONUS depot level maintenance capability. In the early eighties, a number of OCONUS depot level maintenance expansion projects have been proposed and several have been implemented.

B. During the Third Quarter Maintenance Performance Review on 10 August 1983, LTG Richard Thompson, the DCSLOG, asked HQDARCOM/HQDESCOM to establish and keep current, a model to show justification of why we do work in Germany rather than in the United States (reference 1). About the same time, HQDARCOM, DRCPP-IR, was providing guidance to the MSCs and DESCOM on how to evaluate the possible expansion of Mainz Army Depot (reference 2). They said that when discussing alternatives to providing support at Mainz, consider economic and readiness advantages and disadvantages. Also, consider not performing any depot level repair in Europe as an alternative. Alternatives should have impacts associated with each. Consider especially impacts on CONUS depots, such as workload, jobs, etc.

II. LITERATURE SEARCH

A. In researching the literature for guidance and existing models, no existing model was found which covered all aspects of the questions adequately. The MSCs and HQDESCOM have looked at transportation costs, facility costs, equipment costs, and sometimes, increased pipeline costs, to maintain the same level of readiness. These cost elements provide the basic framework of the final model, but do not consider the value of the CONUS jobs. The Employment Act of 1946 (reference 3) declares "it is the continuing policy and responsibility of the Federal Government . . . to promote maximum employment, production, and purchasing power." In a 1965 article (reference 3), the Council of Economic Advisors explain that an idle resource environment responds differently to additional work than a full employment environment.

B. Other documents contained more specific guidance on cost modeling. Mr. Fisher of Rand Corporation (reference 4) proposes that the cost to other Federal Agencies and local government be included in military cost models. Similarly, AR 11-28, states that direct and indirect costs should be considered. The Supplement to OMB Circular A-76 and its Addendum No. 1 require that Federal,State,and Local Income Taxes be included in the cost comparison to determine the least cost to the Government. Comprehensive Employment and Training Act (CETA) reports (reference 7) show that creating CONUS jobs reduces unemployment and welfare costs. The Construction Engineering Research Laboratory (CERL) of the Corps of Engineers, have developed several economic computer models (references 8 and 9) to provide the local social and economic impacts of base realignments required for the Case Study Justification Folder (CSJF) documentation. Although these models estimate the total increase or decrease in local jobs and local tax revenue, our needs are the total CONUS job and tax impacts of various alternatives.

III. MODEL OVERVIEW

A. The model includes all the cost elements listed below:

1. Recurring Costs

   a. Labor

   b. Packing and Transportation

2. Non-Recurring Costs

   a. Facilities

   b. Equipment

   c. Pipeline

   d. Training

B. Generally, new systems should not be modeled as a whole because this may provide a suboptimum solution. Frequently, a few complicated modules or NSNs may require expensive test and repair equipment or facilities. The return of these modules or NSNs to a CONUS facility separate from the total major system or a major subsystem should be considered one possible alternative. Older systems already being done OCONUS could be modeled at the total system level because no additional equipment or facilities would be required.

C. This model quantifies the dollar value of CONUS jobs by estimating the Federal, State, and Local income taxes from those jobs and the reduction in unemployment and welfare benefits. Hence, the model computes the net cost to the U.S. taxpayer. It also calculates the gross costs because the actual outlays required may be of interest to some users. The detailed calculations are in the next several chapters.

IV. RECURRING COST CALCULATIONS

A. The first annual or recurring cost element which may vary significantly between depot sites is the maintenance labor cost to perform the overhaul, repair, modification, or conversion of the item, or items, being analyzed. Although the Mainz-CONUS Comparability Study concluded that the CONUS overhead costs are somewhat higher than Mainz's, it suggests that much of these costs are fixed. Hence, the major overhaul variable cost is the total maintenance labor cost including direct and indirect maintenance people. Throughout the model we assume that all possible sites will overhaul each item to the same specifications and hence use the same amount of repair parts and direct labor.

B. The net annual maintenance labor cost (NMLC) can be computed by the following equation. The product of the first four factors is the gross maintenance labor cost:

$$\text{NMLC} = \text{TMLF X [(AOQ X DLHS X DLRD) - IM X (Tax X AOQ X DLHS X (DLRD - CFB)) - EM X (AOQ X DLHS/PMPM X RUC)]}$$

1. TMLF is the total maintenance labor factor which converts direct labor hours and therefore direct labor costs into total maintenance labor hours or cost. When the depots add 100 direct labor maintenance people, they also add a certain number or percentage of supervisors, secretaries, clerks, methods and standards people, repair parts expediters, production controllers, etc. These factors are in Table 1 of Appendix A.

2. AOQ is the projected annual overhaul, repair, conversion, or modification quantity.

3. DLHS is the direct labor hours standard to perform this overhaul, repair, conversion, or modification. The CONUS depot standard or estimate (for new systems) should be used for both the CONUS and OCONUS standard so that the level of overhaul is consistent. The one exception to that rule will be the use of the OCONUS standard or estimate for Theater Asset Repair Program (TARP) items for both the CONUS and OCONUS site, since the scope of work is somewhat less than normal depot level work.

4. DLRD is the direct labor rate in dollars. The FY84 rate for each depot is in Table 1 of Appendix A.

5. IM is the income multiplier. When new jobs are created, these people create additional new jobs by eating out more, buying new furniture, building new houses, etc. Hence, the original new jobs or income multiplies throughout the local and national economy. See references 9 and 10 for more background on multipliers and descriptions of how they are computed. We recommend using the Federal Government Enterprises multipliers (Table 3) because they are more conservative (smaller) than some others. Also, they are probably more accurate because the major component of this "industry" is the Postal Service, which uses very few materials or repair parts. In depot maintenance, a lot of repair parts and materials are used but these would be used at an OCONUS depot site as well as a CONUS site, so their effects on secondary jobs and income should be ignored.

6. Tax % is the total U. S. income tax rate for the geographic area of that depot. It does not include Social Security or property taxes which might be paid. These rates are listed in Table 2.

7. CFB is the cost of fringe benefits. These are not directly taxable and are excluded from the tax estimating computations. See Table 1.

8. EM is the employment multiplier. See paragraph 5 above for explanation.

9. PMPM is the productive manhours per manyear shown in Table 2. It is used to convert the workload in direct labor hours into the number of people required to do that workload.

10. RUC in the average annual reduction in unemployment costs per person hired. These estimates vary by state and are tabulated in Table 4 and were generated as described in Appendix C.

C. The second annual or recurring cost element is the packing and transportation cost.

1. For CONUS overhaul, each item would have to be packed at an OCONUS site, transported to the CONUS site, packed and loaded after overhaul, and transported back to an OCONUS location. The equation for the gross cost of this total cost is the following if the transportation costs are the same in both directions:

$$GORT = OPCH + 2OLH + 2OPH + 2AOS + 2CPH + 2CLH + CPCH$$

a. GORT is the gross cost of the annual OCONUS round trip transportation.

b. OPCH is the difference in the OCONUS packing, crating, handling, and outloading costs between what is required to prepare the annual quantity of this item for transocean shipment versus the packing, crating, handling, and outloading costs which would be required to prepare the annual quantity of these items for shipment back to an OCONUS unit from an OCONUS overhaul site.

c. OLH is the additional OCONUS line haul cost to get the annual quantity of this item to the OCONUS port from which it would be shipped instead of an OCONUS depot such as MZAD. The MSC or HQDESCOM transportation experts should provide this value.

d. OPH is the OCONUS port handling cost. Again, MSC or HQDESCOM transportation people should provide this cost and those in e, f, and g.

e. AOS is the cost of shipping the annual quantity of this item across the ocean.

f. CPH is the annual CONUS port handling cost.

g. CLH is the annual CONUS line haul to the designated CONUS depot.

h. CPCH is the difference in the CONUS packing, crating, handling, and outloading costs between what is required to prepare the annual quantity of this item for transocean shipment versus the packing, crating, handling, and outloading costs which would be required to prepare the annual quantity of these items for shipment to a CONUS unit.

2. The net cost which considers the benefits of the CONUS job is given below:

$$NORT = OPCH + 2OLH + 2OPH + 2NAOS + 2NCPH + 2NCLH + NCPCH$$

a. NORT is the net cost of the annual OCONUS roundtrip transportation.

b. OPCH, OLH, and OPH were described above.

c. $NAOS = AOS - Tax\ \% \times TIPD \times AOS - TJPM \times AOS/1{,}000{,}000 \times RUC$

(1) NAOS is the net annual cost of shipping these items across the ocean.

(2) AOS is the gross cost of shipping the annual quantity of items across the ocean.

(3) Tax % is the depot average total U. S. Income Tax rate from Table 2.

(4) TIPD is the total income/$1 expended factor for the transportation and warehousing industry in Table 3.

(5) TJPM is the total jobs/$1M expended factor for the transportation and warehousing industry in Table 3.

(6) RUC is the average total annual reduction in unemployment costs per hire factor from Table 4.

d. NCPH, the net CONUS port handling cost, and NCLH, the net CONUS line haul cost, are computed from CPH and CLH in the same manner and using the same factors as in the equation for NAOS.

e. NCPCH, the net CONUS packing, crating, handling, and outloading cost, is computed from CPCH in the same manner as NAOS, except that the Federal Government Enterprises factors from Table 3 and the RUC factor for the depot state are used.

3. For OCONUS overhaul, the repair parts and conversion kits, if any, must be shipped to the OCONUS site. The gross cost of this extra shipping is given by the following equation:

$$GOSR = RAO + ORPH + ORLH$$

a. GOSR is the gross annual cost of the OCONUS shipment of repair parts and conversion kits, if any.

b. RAO is the gross cost of shipping across the ocean all the repair parts and conversion kits, if any, required to support the annual overhaul quantity of this major item. First, the weight of the repair parts and conversion kits must be estimated by the project manager people or depot people. Then the MSC or HQDESCOM transportation people can estimate this cost and the next two costs.

c. ORPH is the gross annual OCONUS repair parts port handling cost.

d. ORLH is the gross annual OCONUS repair parts line haul cost.

4. The net cost which considers the benefits of the CONUS jobs is given below:

$$NOSR = ORPH + ORLH + NRAO$$

a. NOSR is the net annual cost of the OCONUS shipment of repair parts and conversion kits, if any.

b. ORPH and ORLH were defined in paragraphs 3c and 3d.

c. NRAO is the net annual cost of shipping across the ocean all the repair parts and conversion kits, if any. It is computed using the same factors as in paragraph 2c:

$$NRAO = RAO - Tax\ \%\ X\ TIPD\ X\ RAO - TJPM\ X\ RAO/1{,}000{,}000\ X\ RUC$$

V. NON-RECURRING COSTS

A. There are five major types of one-time or non-recurring costs which may be required by an alternative. The first of these is one or several facility costs:

1. Occasionally, as in the Magirus Deutz bus plant, the US Army buys an existing building. Since this would not create any construction jobs, the net puchase cost is equal to the gross purchase price.

2. The net U.S. cost of new construction at an OCONUS site is equal to the estimated gross cost. The net U. S. cost of new construction at a CONUS site (NCNC) is given by the following equation:

$$NCNC = GCNC - Tax\ \%\ X\ TIPD\ X\ GCNC - TJPM\ X\ GCNC/1{,}000{,}800\ X\ RUC$$

a. GCNC is the gross cost of the new construction.

b. Tax % is the specific CONUS depot total U.S. income tax rate from Table 2.

c. TIPD is the total income/$1 expended factor for the new construction industry in Table 3.

d. TJPM is the total job/$1M expended factor for the new construction industry in Table 3.

e. RUC is the total annual reduction in unemployment costs per hire factor for the CONUS depot site from Table 4.

3. The net U. S. cost of refurbishing an OCONUS facility is equal to the estimated gross cost. The net U. S. cost of facility refurbishment at a CONUS site (NCFR) is computed from the gross cost by the same type of equation as shown in paragraph 2 above. However, the TIPD and TJPM factors should be taken from the Repair and Maintenance Construction industry of Table 3.

B. The second type of one-time or non-recurring cost is additional equipment cost. The gross cost of this equipment (GCE) should include free issue or standard equipment because this equipment may be free to the depot facility, but it is not free to the U. S. Government. The net U. S. cost of new additional equipment at any site (CONUS or OCONUS) is given by the following equations:

$$NCE = GCE - Tax\ \%\ X\ TIPD\ X\ (GCE - EPO) - TJPM\ X\ (GCE-EPO)/1{,}000{,}000\ X\ RUC$$

1. Tax % is the depot average total U. S. income tax rate from Table 2.

2. TIPD is the total income/$1 expended factor for the electrical industrial equipment industry in Table 3.

3. OPE is the dollar value of the equipment which is e to be procured from local OCONUS sources. The items may includ benches, cranes, material handling equipment, etc.

4. TJPM is the total jobs/$1M expended factor for the industrial equipment industry in Table 3.

5. RUC is the average total annual reduction in unempl costs per hire factor from Table 4.

C. The third type of one-time or non-recurring cost is the the increase required in the pipeline to maintain the same leve readiness.

1. For CONUS overhaul, the pipeline increase cost is t value of the major items or assemblies which would be intransit OCONUS collection point to the CONUS depot and from the CONUS d to an OCONUS distribution point.

a. The gross major item pipeline increase (GMIPI) by the following equation:

GMIPI = TITW/52 X AOQ X UPP

(1) TITW is the time intransit in weeks to the depot and from the depot. It does not include the actual overh since the OCONUS site should take about the same time to perfor overhaul. The HQDESCOM transportation people feel that an eigh is an appropriate conservative estimate from Europe to Sacramen and six weeks for all the other depots for surface transportati

(2) AOQ is the annual overhaul quantity of thi

(3) UPP is the current or estimated unit purch this item.

b. The net major item pipeline increase (NMIPI) is as follows:

NMIPI = GMIPI - Tax % X TIPD X GMIPI - TJPM X GMIPI

(1) The average rates are used for Tax in Ta in Table 4.

(2) The industry which best describes the type should be used in selecting TIPD and TJPM from Table 3. These include aircraft and parts, motor vehicles, construction and ma ment, etc.

2. For OCONUS overhaul, the pipeline increase cost is value of the additional repair parts and conversion kits, if an fill the OCONUS repair parts pipeline.

a. The gross repair parts pipeline increase (GRPPI) is computed by the following equation:

GRPPI = ADP/365 X ACRP

(1) ADP is the additional days of repair parts pipeline. HQDESCOM transportation people estimate this value as 21 days assuming 80% of the repair parts are shipped by surface to Europe and 20% by air.

(2) ACRP is the annual cost of all the repair parts and conversion kits, if any, required to overhaul the annual quantity of this item.

b. The net repair parts pipeline increase (NRPPI) is computed as the net major item pipeline increase in paragraph C1b above.

NRPPI = GRPPI - Tax % X TIPD X GRPPI - TJPM X GRPPI/1,000,000 X RUC

D. The fourth and final one-time or non-recurring cost is any training cost. If the gross training cost is GTC, then the net training cost (NTC) can be computed as follows:

NTC = GTC - Tax % X TIPD X (GTC - OTC) - TJPM X GTC-OTC)/1,000,000 X RUC

1. Average rates are used for Tax %, TIPD, TJPM, and RUC.

2. OTC is an estimate of the training cost which will be spent OCONUS or on OCONUS airlines for travel.

VI. DECISION PROCESS

A. BOTTOM LINE(S)

The least expensive alternative for the U.S. taxpayer is the alternative which has the lowest total present value cost over a ten or 25 year time period. A 25 year time period is required for a new facility purchase or construction. A ten year period is adequate to spread other non-recurring costs.

1. The non-recurring costs to be incurred in each year is added to the recurring costs for that year to determine the total annual cost for each alternative. Many non-recurring costs, such as facility, equipment, training, etc., are normally incurred over several years. Pipeline increases are non-recurring, but may be incremental. In year 1, the pipeline may require 5 additional major items or assemblies and in year 2 a total of 9 items may be required due to increased fielding. In year 1, there is a non-recurring cost for 5 items to fill the pipeline and in year 2, there is a non-recurring cost for 4 more pipeline items. For older items, such as the M60 tank, it may be impossible or impractical to buy additional pipeline. If so, the cost of increased pipeline should not be included in the total annual cost; however, the reduced readiness should be noted as a non-quantifiable factor in the decision process as described in paragraph C1. Each total annual cost over the 10 or 25 year time period is multiplied by its discount factor from AR 11-28 and a total present value cost is computed for each alternative. Uniform annual costs, savings to investment ratios, and amortization periods can be computed (see AR 11-28) to measure how much better one alternative is than others.

2. The annual costs for all items may be combined to justify or analyze the purchase of a facility, the construction of a facility, or the expansion of a facility. However, this combination may produce a suboptimum solution if the specific items are not individually analyzed. The negative savings from one or more items or NSNs may be hidden by positive savings from other items. A review of the equipment costs for each item may indicate that certain items should have assemblies or NSNs returned for CONUS overhaul. An individual analysis of all costs, except facility costs, for each item will quantify the relative magnitude of each item's contribution toward justifying a new or additional facility. This individual analysis is particularly useful when not all items can be worked OCONUS and some rule is needed to determine which items should be retrograded to CONUS.

B. SENSITIVITY ANALYSIS.

Once a comparison of two or more alternatives has been completed, for one set of estimates and the FY84 depot factors, the decision maker would be wise to consider how changes in key parameters might change the results. For example, the FY84 Mainz labor rate is based on 2.7 DM per dollar. The 1981 DM per dollar rate at Mainz was 1.78. Another parameter is the failure (or overhaul) frequency of end items or assemblies such as engines, transmissions, etc. If the original best alternative remains the best over a reasonable range of these key parameters, then it is a stable, safe solution.

C. NON-QUANTIFIABLE FACTORS.

Although this model quantifies many cost elements not quantified in other models, there are still several factors, not quantifiable, to be considered in the decision process.

1. The model considers all types of taxpayer do``ars to be interchangeable, but the Army cannot pay transportation costs with state income tax dollars. Procurement dollars may not be available to buy the additional major item pipeline required to maintain the same level or readiness. Then, the decision maker may have to decide between an alternative which is less expensive but provides reduced readiness and other alternatives which are more expensive to the U. S. Taxpayer but provide better readiness.

2. Mobilization support capability is a double edged sword. An OCONUS depot site reduces the peacetime and mobilization transportation requirements. However, many OCONUS sites close to borders are vulnerable to being destroyed soon after a mobilization situation.

3. Special maintenance agreements may specify that if a country buys a U. S. system, then they will perform some or all of the maintenance on that system. Even here, the model may be useful in determining which parts of a system are best done in that country and what the acutal cost of this agreement is to the U. S. taxpayer.

VII. CONCLUSIONS.

A. This model provides the best available means of comparing the true costs to the U. S. taxpayer of European depot maintenance versus CONUS depot maintenance for an individual item or group of items. The model could evaluate other OCONUS locations if labor rates were provided for those sites. The model can assist in determining the most cost effective items to workload into an OCONUS site when there is not enough space to do all items and some will be retrograded to CONUS for overhaul or repair.

B. Preliminary results indicate that at the current DM per dollar rate, the European overhaul of most, but not all, larger items which do not require additional expensive equipment is cost justified. Results for specific sample items are shown in Appendix F. Some of the primary factors in the model are the DM per dollar rate, the item's size and cost, the overhaul manhours per unit, and the additional special equipment and facilities. The most significant single factor appears to be MHRS/MTON - the labor manhours for depot level overhaul per unit/the measurement tons (volume/40) per unit. Secondary factors include the location, tax rate, and labor rates of the CONUS depot. A detailed factor (parameter) analysis appears in Appendix E.

APPENDIX A

FY84 DEPOT AND ECONOMIC FACTORS

Table 1

Depot	Total Maint Labor Factor	Direct Labor Rate *	Cost of Fringe Benefits
Anniston Army Depot	1.56	$ 13.22	$ 1.51
Corpus Christi Army Depot	1.64	14.40	1.56
Letterkenny Army Depot	1.56	13.65	1.57
Red River Army Depot	1.52	12.78	1.16
Sacramento Army Depot	1.61	15.41	1.42
Tobyhanna Army Depot	1.33	12.92	1.38
Tooele Army Depot	1.52	14.31	1.50
Mainz Army Depot	1.39	11.02 at 2.7 DM/$1	

*These are average skill level rates. Rates for very high skill level jobs could be estimated based on specific grade levels.

Table 2

Depot	Total U.S. Tax Rate	Productive Mhrs/Myr
Anniston Army Depot	13.8%	1749
Corpus Christi Army Depot	11.7%	1750
Letterkenny Army Depot	15.1%	1757
Red River Army Depot	11.7%	1739
Sacramento Army Depot	13.1%	1739
Tobyhanna Army Depot	16.1%	1755
Tooele Army Depot	15.7%	1751
Mainz Army Depot	0.0% **	N/A
Depot Average	13.9%	N/A

** A factor of 11.0% would be used if Department of Army Civilians performed the actual work at Mainz, as in the case of some MICOM maintenance.

Table 3

Industry	Total Jobs/ $1M Expended (FY84 $)	Total Income/ $1 Expended (FY84 $)	Employment Multiplier	Income Multiplier
New Construction	52	$ .486		
Repair & Maint Const.	57	.545	3.757	2.992
Engine & Turbine	52	.523		
Const & Mining Equip	45	.445		
Elect Industrial Equip	65	.606		
Motor Vehicles	60	.591		
Aircraft & Parts	68	.685		
Transp & Warehousing	55	.533		
Fed Gov't Enterprises	96	.908	2.741	2.384
OCONUS Maint by DACs	N/A	N/A	1.333	1.333

Table 4

State	Total Annual Reduction in Unemployment Costs (RUC) per Hire	Depots
Alabama	$ 715.81	Anniston Army Depot
California	1,455.84	Sacramento Army Depot
Pennsylvania	1,378.52	Letterkenny and Tobyhanna Army Depots
Texas	996.28	Corpus Christi and Red River Army Depots
Utah	1,299.01	Tooele Army Depot
Average	1,169.09	All New Procurement

APPENDIX B

SOURCES OF DEPOT AND ECONOMIC FACTORS

Table	Data Element	Source
1	Total Maint Labor Factor	a. For CONUS depots, it was computed from the DESCOM Manpower Evaluation Report. b. For Mainz, it was computed from the 1981 Mainz-CONUS Comparability Study and confirmed by the Mainz Army Depot COMMEL Program Plan, prepared by MIP-PGO dated February 1984.
1	Direct Labor Rate	a. For CONUS depots, it was extracted from the FY84 AIF Budget Mark. b. For Mainz, it was provided by M. Johnson at Mainz.
1	Cost of Fringe Benefits	SAE Office called the Budget Office at each depot.
2	Total U.S. Tax Rate	a. Federal tax rate was estimated from FY81 actual data in IRS, SOI Bulletin, Fall 1983, and actual Dept of Labor data on pay increases for FY82 and FY83 printed in USA Today by Marcy Mullins. b. State sales tax rate was taken from IRS Sales Tax Tables for FY83. c. Local and State Income Taxes were obtained from depot's Finance and Accounting Offices.
2	Productive Manhours/Manyears	DESCOM P7M direct and indirect labor report.
3	Total Jobs/$1M Expended	Provided by Mr. Dennis Robinson of the Corps of Engineers Construction Engineering Research Laboratory (CERL). The values were computed by CERL computer models using the 1972 Input - Output Tables (the latest available), which were published and distributed by the Dept of Commerce in 1979. Dollar results were converted from 1972 dollars to FY84 dollars.

APPENDIX B (CONTINUED)

Table	Data Element	Source
3	Total Income/$1 Expended	Provided by Mr. Dennis Robinson of the Corps of Engineers Construction Engineering Research Laboratory (CERL). The values were computed by CERL computer models using the 1972 Input - Output Tables (the latest available), which were published and distributed by the Dept of Commerce in 1979. Dollar results were converted from 1972 dollars to FY84 dollars.
3	Employment Multiplier - Repair & Maint Const - Fed Gov't Enterprises	Provided by Mr. Dennis Robinson of the Corps of Engineers Construction Engineering Research Laboratory (CERL). The values were computed by CERL computer models using the 1972 Input - Output Tables (the latest available), which were published and distributed by the Dept of Commerce in 1979. Dollar results were converted from 1972 dollars to FY84 dollars.
3	Employment Multiplier - OCONUS Maint by DACs	No source of these multipliers could be found. Hence, we selected very conservative factors. DACs would have to pay Federal Income taxes, which provide a multiplier of 1.0. They would spend much of their pay-check in the local OCONUS site but at least a small portion would be spent in the U.S. or on U.S. products.
3	Income Multiplier - Repair & Maint Const - Fed Gov't Enterprises	Provided by Mr. Dennis Robinson of the Corps of Engineers Construction Engineering Research Laboratory (CERL). The values were computed by CERL computer models using the 1972 Input - Output Tables (the latest available), which were published and distributed by the Dept of Commerce in 1979. Dollar results were converted from 1972 dollars to FY84 dollars.

APPENDIX B (CONTINUED)

Table	Data Element	Source
3	Income Multiplier - OCONUS Maint by DACs	No source of these multipliers could be found. Hence, we selected very conservative factors. DACs would have to pay Federal Income Taxes, which provide a multiplier of 1.0. They would spend much of their pay-check in the local OCONUS site but at least a small portion would be spent in the U.S. or on U.S. products.
4	Total Annual Reduction in Unemployment Costs (RUC) per Hire	This factor was estimated based on unemployment insurance (UI), aid to families with dependent children (AFDC), food stamps (FS), and actual CETA Public Service Employment rates. See Appendix C for these rates and their sources.

APPENDIX C

REDUCTION IN UNEMPLOYMENT COSTS AND OCONUS DAC EXTRA COSTS

UNEMPLOYMENT INSURANCE (UI) PAYMENTS

State	Average Payment/Week	Depot
Alabama	$ 83.39	Anniston Army Depot
California	109.39	Sacramento Army Depot
Pennsylvania	146.79	Letterkenny Army Depot and Tobyhanna Army Depot
Texas	138.36	Corpus Christi Army Depot and Red River Army Depot
Utah	127.80	Tooele Army Depot

AS OF: July-September 1983

SOURCE: ETA 5159 Report Claims and Payment Activities, dated 11/02/83, Department of Labor

AID TO FAMILIES WITH DEPENDENT CHILDREN (AFDC)

	Maximum Benefits by Family Size/Month		
State	Two-Person Family	Three-Person Family	Six-Person Family
Alabama	$ 88.00	$ 118.00	$ 206.00
California	424.00	526.00	802.00
Pennsylvania	273.00	350.00	514.00
Texas	85.00	117.00	183.00
Utah	286.00	362.00	540.00

AS OF: September 1983

SOURCE: Background Material on Poverty, printed for Subcommittee on Oversight and Subcommittee on Public Assistance and Unemployment Compensation of the Committee on Ways and Means, dated 17 Oct 83

DESCOM RECOMMENDATION: Use Two-Person Column.

APPENDIX C (CONTINUED)

FOOD STAMPS

All states average monthly, FY83 = $42.99 benefit per participant.

AS OF: 17 Jan 84

SOURCE: Mr. Dyson, Dept of Agriculture, FTS 756-3189

DESCOM RECOMMENDATION: Use twice this figure for each Food Stamp participant hired.

PERCENT NEW HIRES DRAWING UI, AFDC, OR FOOD STAMPS

1. Unemployment Insurance (UI) - 10%
2. Aid to Family with Dependent Children (AFDC) - 15%
3. Food Stamps (FS) - 12%

SOURCE FOR 1 AND 2: Actual CETA Public Service Employment experience for FY77-78, Dept of Labor Table, CETA: Assessment of Public Service Employment Programs, William Mirengoff, et al, National Academy of Sciences, Washington, DC, 1980

SOURCE FOR 3: Penna. Dept of Welfare, Chambersburg Office, estimates that 90% of people drawing AFDC qualify for and receive Food Stamps.

OCONUS DAC HOUSING ALLOWANCE

WG-12 in Europe were receiving $7,600/year.

AS OF: January 1984

SOURCE: Mr. Steele, Letterkenny Project Officer for their European Missile Facility.

OCONUS DAC MOVING EXPENSES

$45,000 per family, normally 3 year stay

AS OF: January 1984

SOURCE: Mr. Steele, Letterkenny

ESTIMATED COST PER DIRECT LABOR HOUR

(7,600 X 3 + 45,000) / (1,750 MHRS/MYR X 3) = $12.91

APPENDIX D

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7. Mirengoff, W.; Rindler, L.; Greenspan, H.; and Seablom, S., "CETA: Assessment of Public Service Employment Programs", National Academy of Sciences, 1980.

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APPENDIX E

MODEL PARAMETER ANALYSIS

1. PURPOSE. To determine the primary and secondary parameters in the CONUS vs OCONUS Cost Comparison Model.

2. FACTS.

a. The parameters can be classified as parameters which describe a specific item and its projected workload (specific item parameters) and parameters which describe depot and common economic factors (general purpose parameters). The following major parameters and their effects will be analyzed in varying detail:

(1) Specific Item Parameters

(a) MHRS/Unit
(b) Measurement Tons (Volume/40)/Unit
(c) Type of Item
(d) Unit Price
(e) Additional Facility and Equipment Costs
(f) Annual Overhaul Quantity

(2) General Purpose Parameters

(a) Depot Maintenance Direct Labor AIF Rates
(b) Depot Indirect to Direct Ratios
(c) The DM/$1 Exchange Rate
(d) Tax Rates
(e) Employment and Income Multipliers

b. Our initial calculations showed that in general, a large MHRS/Unit value would provide large CONUS tax returns while large sizes, MTONS (Measurement Tons)/Unit, would generate large transportation costs and large pipeline costs because larger items frequently have a large unit purchase cost. To combine these several parameters into one parameter for ease of presentation and analysis, a new parameter MHRS/MTON was computed for each item. Figure 1 (TAB A) shows how the savings for OCONUS depot overhaul versus returning items to CONUS vary as the MHRS/MTON per item vary. These 21 points represent the first 10 COMMEL items to be phased into MZAD and a variety of 11 items currently being done by MZAD. The CONUS and OCONUS costs are 10 year cost estimates including increased major item/assembly and repair parts pipeline increases necessary to maintain the same level of readiness. The actual investment needed to establish the MZAD COMMEL facility has not been included in Figure 1 because that data is not available for the 11 items currently being overhauled at MZAD. All costs were computed at an exchange rate of $2.7DM/$1.

c. For items whose overhaul/repair consumes less than 50 MHRS costs from 40-70% less than the appropriate CONUS depot. At arou MTON, the OCONUS and CONUS costs are about equal. Beyond 100 MHR direct labor rates, indirect to direct ratios, and pipeline costs major factors. For example, TOAD has one of the lowest maintenan labor rates and indirect to direct ratios. Its four items, which are consistently below the other points. Sacramento has signific maintenance direct labor rates and indirect to direct ratios. Th items are in boxes to show the relative differences for items wit MHRS/MTON due to these and other factors. The TOAD and SAAD iten MHRS/MTON have about the same pipeline costs and an average of 13 in total cost savings. The 47% difference between the TOAD and S 225 MHRS/MTON is due in part to these rates and ratio differences SAAD item has a unit purchase price twice the TOAD item, the annu quantity of the SAAD item is 10 times the TOAD item, and we allow two weeks for round trip transportation to SAAD. The combination 3 parameter differences produces a SAAD major item pipeline cost 27 times the TOAD major item pipeline cost, a one-time dollar dif $179,000.

d. When the actual MZAD COMMEL investment (facility renovatio equipment costs, and training costs) costs are distributed to inc items, based on their annual manhours of effort, the MHRS/MTON li by about 8% for small MHRS/MTON and a maximum of 21 for the larg MTON (see Figure 2, TAB B). The effects of a $1M capital investm current 11 MZAD items vary depending on the annual manhours and t line costs. For the Aux Gen M88A1, the $1M investment reduces t savings by 9%. For the M60A1-A3 and 1790 engine respectively, a investment reduces the 10 year OCONUS savings by 1 and 2 respec Even if we weigh the investment cost by annual manhours for these by considering a $1M investment cost per 100,000 manhours per yea 6, 4 and 7% decreases in savings for these items. The M60A1-A3 d is smaller because its pipeline costs are larger for the same amo manhours of work than the other two items.

e. All calculations to this point have used the FY84 DM/$1 ob rate of 2.7DM/$1. If the actual average DM/$1 disbursing rate be FY76 and FY83 (Table 1, TAB C) of 2.24 DM/$1 is used, significant differences in the savings can be seen by the blue points and lin Figure 3 (TAB D). This 17% decrease in the value of the dollar r OCONUS savings decreases of 8% for the smaller MHRS/MTON to over the larger MHRS/MTON.

f. In estimating the additional tax revenues, we used conserv estimates for each depot which averaged 14%. The Tax Foundation April 1984 article estimated an average Federal only tax payment 25%, including Social Security gasoline, liquor, tobacco, air tr amd tariffs on imported products. Some of these taxes, such as S

Security (SS) and gasoline will result in additional costs or liabilities for SS benefits and highway repairs. For sensitivity analysis, when a total net tax rate of 21%, a 50% increase in this parameter, was used, the OCONUS savings on the 1790 engine with a 2.24 DM/$1 rate dropped from 30% to 16%. With the higher tax rate, the dollar would have to drop to around 1.52 DM/$1 before it would be cost effective to return 1790 engines to CONUS for overhaul. The annual DM/$ disbursement rate has never been below 1.79 DM/$, the FY80 rate (see Table 1, TAB C).

g. The employment and income multipliers were computed using official Department of Commerce input-output data using standard mathematical equations. New Department of Commerce data is provided to the public only every five years. These parameters have an impact about 1.25 times the total net tax rate. For example, while a 50% increase in the tax rate reduced the OCONUS savings on the 1790 engine from 30% to 16%, a 50% increase in all multipliers would reduce the 1790 savings from 30% to 13%.

h. Now that a computer terminal, the MAXICALC electronic spreadsheet, and a trained statistical assistant are available, the CONUS vs OCONUS Cost Comparison Model is being automated. When completed, more detailed sensitivity analyses can be performed more quickly and accurately and other additional items could be added more quickly.

i. Summary. The predominate single parameter is MHRS/MTON for values of MHRS/MTON less than 100. Beyond 100, other parameters, such as pipeline costs, depot rates, and facility and equipment costs become as important. The DM/$1 rate, tax rate changes, and multiplier changes will shift the MHRS/MTON line while retaining the same general shape. There will be slightly larger changes for larger MHRS/MTON items because these parameters affect the CONUS vs OCONUS labor costs more than the other major cost elements.

MHRS/MTON AND OCONUS SAVINGS RELATIONSHIPS

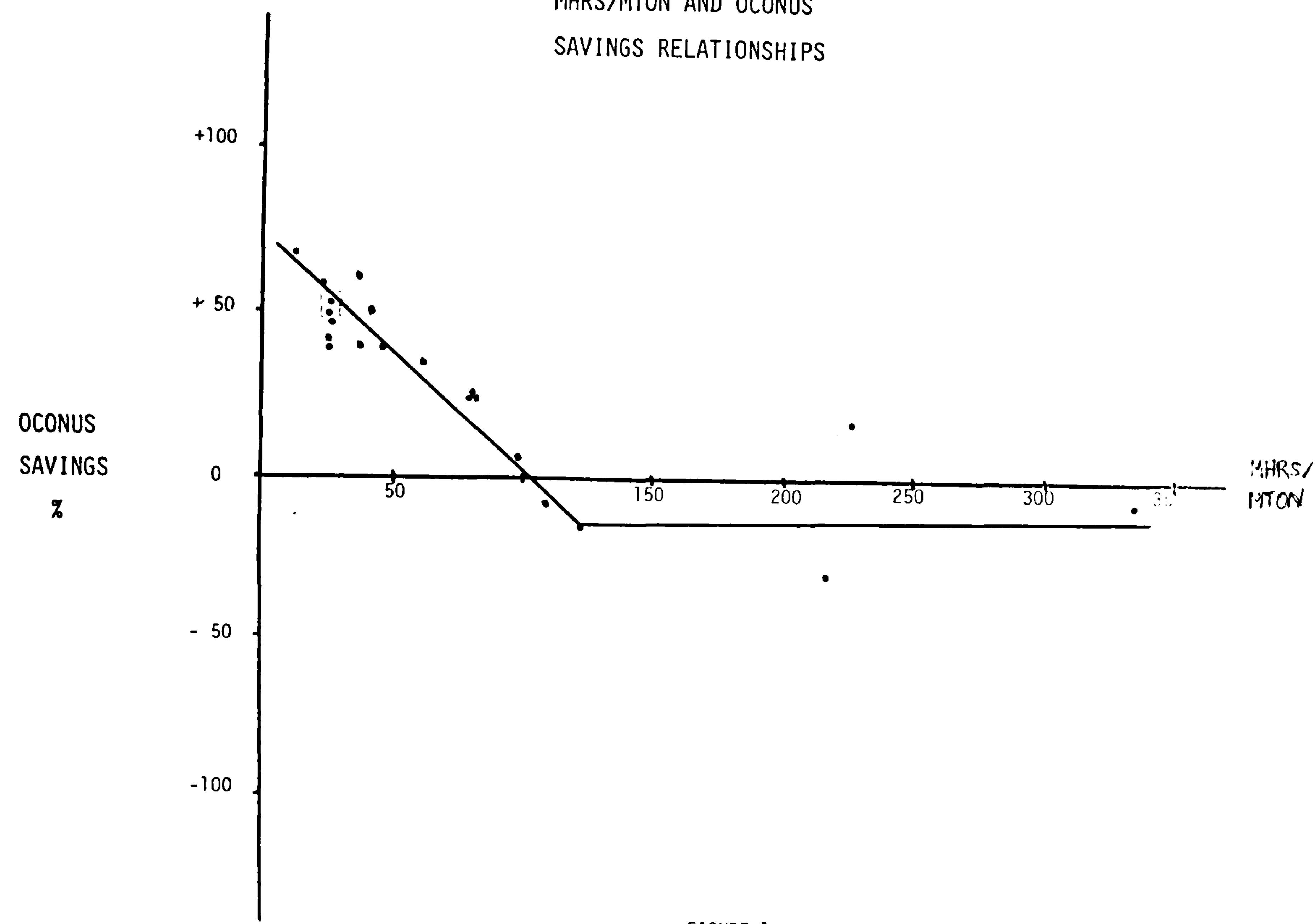

FIGURE 1

MHRS/MTON AND OCONUS

SAVINGS RELATIONSHIPS

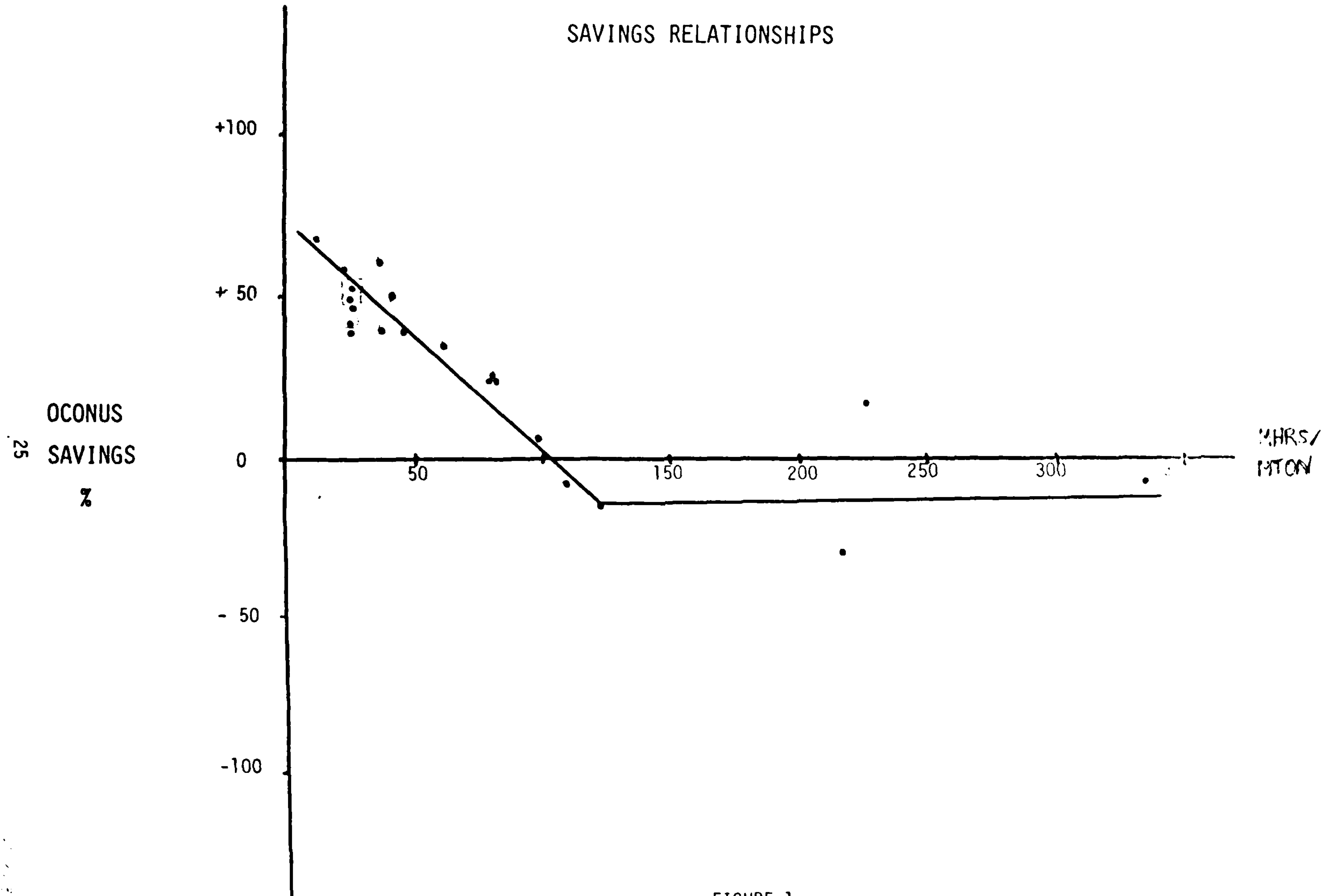

FIGURE 1

MHRS/MTON AND OCONUS SAVINGS RELATIONSHIPS

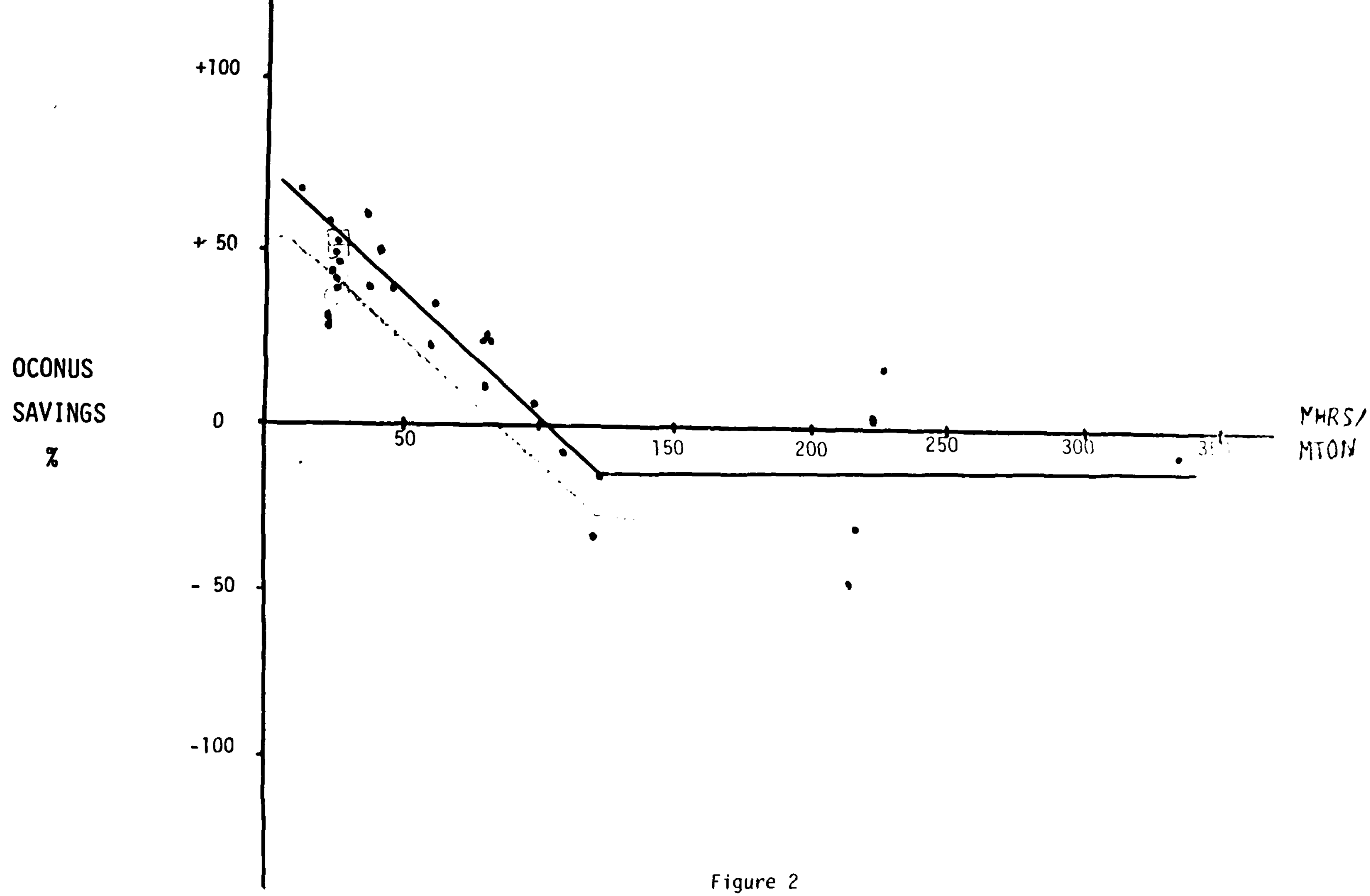

Figure 2

MZAD DM RATE HISTORY

FY	Average DM /Dollar Obligation Rate	Average DM /Dollar Disbursement Rate	
76	2.58	2.58	
77	2.38	2.38	
78	2.11	2.11	
79	2.24	1.85	8 yr
80	2.24	1.79	Avg
81	1.78	2.24	2.24
82	2.26	2.41	
83	2.95	2.53	
84	2.71	TBD	

Table 1

MHRS/MTON AND OCONUS

SAVINGS RELATIONSHIPS

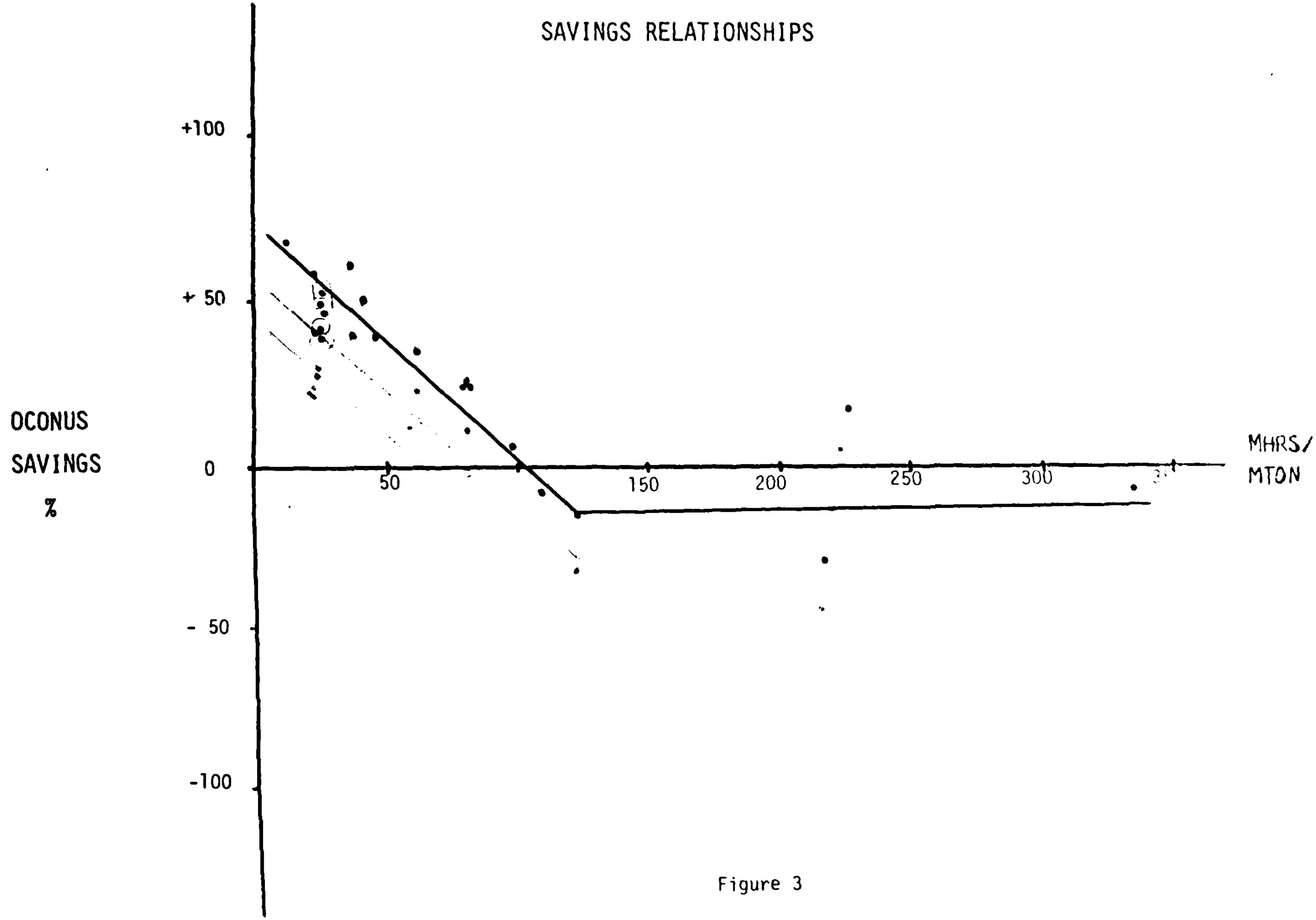

Figure 3

APPENDIX F

SAMPLE ITEM TABULAR RESULTS

1. MHRS/MTON is the depot overhaul manhour standard divided by measurement tons (cu. ft./40) per item.

2. MODEL RESULTS are the relative net governmental cost savings percentage equals (CONUS ten year costs minus OCONUS ten year costs) divided by CONUS ten year costs. Hence, a -8% means over a 10 year period, it is 8% cheaper to retrograde this item from Europe to CONUS for depot overhaul. A +7% means it would be 7% cheaper to overhaul that item in Europe.

3. There is a basic difference in the completeness of the sample current MZAD items and potential MZAD COMMEL items analyses. For the sample current MZAD items, the model only tells the user if it is cost effective to continue to do these items at MZAD, not if the capability should have been established initially, because any facility, equipment and training costs required to initially create the capability to do these items are not now available and were, therefore, not considered in the analysis. For the potential MZAD COMMEL items, the facility renovation, equipment, and training costs to establish the COMMEL facility are included in the OCONUS alternative costs. However, when the model analyzed specific COMMEL items, it was necessary to prorate these total one-time costs based on the item's total manhours because most of these costs could not otherwise be split between items. The cost of originally buying the space to be used for the COMMEL items was not estimated and included in this analysis.

4. Column 1 of model results is based on a 2.7DM/$1 exchange rate which was the FY84 HQDA planning rate when most of the calculations were performed. The 14% tax rate is the average direct tax rate on additional income and jobs. It does not include any estimate of indirect taxes such as alcohol, airline, amusement, tobacco, etc.

5. Column 2 results are based on a 2.24 DM/$1 exchange rate which is the average actual disbursement rate over the eight years prior to FY84. The tax rate remains at 14%.

6. Column 3 results are based on a 2.24 DM/$1 exchange rate and a 21% tax rate to study the effects of using a less conservative estimate of the additional tax revenue which would be generated by additional CONUS jobs.

SAMPLE CURRENT MZAD ITEMS

CONUS vs OCONUS COST MODEL RESULTS

			MODEL RESULTS (+ FOR OCONUS)		
			2.7DM/$1	2.24 DM/$1	
Item	CONUS Depot	MHRS/ MTON	14% Tax Rate	14% Tax Rate	21% Tax Rate
Aim Cir M2A2(TARP)	LEAD	340	- 8%	- 32%	- 63%
Gen 4.2	RRAD	112	- 8%	- 31%	- 81%
6V53 Engine	RRAD	100	+ 7%	- 12%	- 47%
Aux Gen M88A1	ANAD	86	+ 25%	+ 10%	- 7%
1790 Engine	ANAD	46	+ 40%	+ 30%	+ 16%
Launcher M752	ANAD	39	+ 51%	+ 41%	+ 34%
CD850-6A Xmsn	ANAD	36	+ 63%	+ 56%	+ 51%
M11A1-A2	RRAD	36	+ 42%	+ 30%	+ 17%
M60A1-A3	ANAD	26	+ 50%	+ 42%	+ 34%
M578 Rec Veh (TARP)	LEAD	23	+ 60%	+ 52%	+ 48%
Trk Wrkr 5T (TARP)	TEAD	12	+ 70%	+ 64%	+ 61%

MZAD COMMEL ITEMS

CONUS VS OCONUS COST MODEL RESULTS

			MODEL RESULTS (+ FOR OCONUS)		
			2.7 DM/$1	2.24 DM/$1	
Item	CONUS Depot	MHRS/ MTON	14% Tax Rate	14% Tax Rate	21% Tax Rate
Total COMMEL 10 Item Package	SAAD & TOAD	N/A	+ 19%	+ 7%	- 18%
AN/TCC-113	SAAD	231	+ 4%	- 13%	- 48%
AN/TCC-69	TOAD	220	- 50%	- 76%	-110%
AN/TCC-60	TOAD	124	- 25%	- 44%	- 69%
AN/MTC-1	SAAD	83	+ 13%	+ 1%	- 32%
AN/MTC-9	SAAD	81	+ 12%	- 3%	- 34%
AN/ASM-146	SAAD	62	+ 24%	+ 13%	- 11%
AN/ASM-147	TOAD	27	+ 33%	+ 21%	+ 14%
AN/ASM-189	SAAD	27	+ 44%	+ 34%	+ 23%
AN/ASM-190	SAAD	26	+ 45%	+ 35%	+ 22%
AN/MSC-25	TOAD	25	+ 29%	+ 8%	- 1%

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